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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b)

Attorney Docket No. 04198.P003 Total Pages 2

First Named Inventor or Application Identifier Ephraim Zehavi et al.

Express Mail Label No. EL034433368US

ADDRESS TO: **Assistant Commissioner for Patents**
Box Patent Application
Washington, D. C. 20231

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. X Fee Transmittal Form
   (Submit an original, and a duplicate for fee processing)
2. X Specification (Total Pages 28)
   (preferred arrangement set forth below)
   - Descriptive Title of the Invention
   - Cross References to Related Applications
   - Statement Regarding Fed sponsored R & D
   - Reference to Microfiche Appendix
   - Background of the Invention
   - Brief Summary of the Invention
   - Brief Description of the Drawings (if filed)
   - Detailed Description
   - Claims
   - Abstract of the Disclosure
3. X Drawings(s) (35 USC 113) (Total Sheets _____)
4. X Oath or Declaration (Total Pages 4) **unsigned**
   a. ___ Newly Executed (Original or Copy)
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   (for Continuation/Divisional with Box 17 completed) **(Note Box 5 below)**
   i. ___ DELETIONS OF INVENTOR(S) Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
5. __ Incorporation By Reference (useable if Box 4b is checked)
   The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
6. __ Microfiche Computer Program (Appendix)
7. __ Nucleotide and/or Amino Acid Sequence Submission
   (if applicable, all necessary)
   a. ___ Computer Readable Copy
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ACCOMPANYING APPLICATION PARTS

8. _____ Assignment Papers (cover sheet & documents(s))
9. _____ a. 37 CFR 3.73(b) Statement (where there is an assignee)
_____ b. Power of Attorney
10. _____ English Translation Document (if applicable)
11. _____ a. Information Disclosure Statement (IDS)/PTO-1449
_____ b. Copies of IDS Citations
12. _____ Preliminary Amendment
13. X Return Receipt Postcard (MPEP 503) (Should be specifically itemized)
14. X a. Small Entity Statement(s) (unsigned) ~~A.A.~~
b. Statement filed in prior application, Status still proper and desired
15. _____ Certified Copy of Priority Document(s) (if foreign priority is claimed)

16. X Other: Separate Sheet: Certificate of Mailing with Attorney Signature and copy of return postcard.

17. **If a CONTINUING APPLICATION,** check appropriate box and supply the requisite information:

___ Continuation ____ Divisional ____ Continuation-in-part (CIP)

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A WIRELESS APPARATUS HAVING A TRANSCEIVER EQUIPPED TO SUPPORT MULTIPLE WIRELESS COMMUNICATION PROTOCOLS
Inventors: Ephraim Zehavi et al.
Our Reference: 04198.P003

Respectfully submitted,

BLAKELY SOKOLOFF TAYLOR & ZAFMAN, L.L.P.

Date: 11/8/99, 1999

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Serial/Patent No.: not yet assigned Filing/Issue Date: 11/8/99
Client: MOBILIAN (Zehavi et al.)
Title: A Wireless Apparatus Having a Transceiver Equipped to Support Multiple Wireless Communication Protocols
BSTZ File No.: 04198.P003 Atty/Secty Initials: ATA/mjt
Date Mailed: 11/8/99 Docket Due Date: ****

The following has been received in the U.S. Patent & Trademark Office on the date stamped hereon:

- ☐ Amendment/Response (____ pgs.)
- ☐ Appeal Brief (____ pgs.) (in triplicate)
- XX Application - Utility (28 pgs., with cover and abstract)
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- ☐ Assignment and Cover Sheet
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- ☐ Preliminary Amendment (____ pgs.)
- ☐ Reply Brief (____ pgs.)
- ☐ Response to Notice of Missing Parts
- XX Small Entity Declaration for Indep. Inventor/Small Business
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- XX Fee Transmittal, in duplicate

XX Other: Separate page with certificate of mailing and attorney's signature (1 page in duplicate)

Applicant or Patentee: Ephraim Zehavi et al. Attorney's Docket No.: 004198.P003
Serial or Patent No.: not yet assigned
Filed or Issued: November 8, 1999
For: A WIRELESS APPARATUS HAVING A TRANSCEIVER EQUIPPED TO SUPPORT MULTIPLE WIRELESS COMUNICATION PROTOCOLS

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS
37 CFR 1.9 (f) and 1.27(c) - - SMALL BUSINESS CONCERN

I hereby declare that I am:

[____] the owner of the small business concern identified below:
[XX] an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF CONCERN: Mobilian, Inc.
ADDRESS OF CONCERN: 15455 N.W. Greenbrier Pkwy., Ste. 210
Beaverton, OR 97006

I hereby declare that the above identified small business concern qualifies as a small business concern as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under Section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby certify that to the best of my knowledge and belief rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention entitled A WIRELESS APPARATUS HAVING A TRANSCEIVER EQUIPPED TO SUPPORT MULTIPLE WIRELESS COMMUNICATION PROTOCOLS
by inventor(s) Ephraim Zehavi and Ron Nevo
described in

[XX] the specification being filed herewith
[____] application serial no. _____, filed _____
[____] patent no. _____, issued _____

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NAME OF PERSON SIGNING: Ephraim Zehavi
TITLE OF PERSON OTHER THAN OWNER: _____
ADDRESS OF PERSON SIGNING: 15455 N.W. Greenbrier Pkwy., Ste. 210, Beaverton, OR 97006
SIGNATURE: _____ DATE: _____

Our Ref.: 004198.P003

APPLICATION FOR UNITED STATES LETTERS PATENT

FOR

A Wireless Apparatus Having A Transceiver Equipped To Support Multiple Wireless Communication Protocols

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"Express Mail" label number EL034433368US

Date of Deposit November 8, 1999

A Wireless Apparatus Having A Transceiver Equipped To Support Multiple Wireless Communication Protocols

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to the field of wireless communication. More specifically, the present invention relates to the problem of concurrent wireless communication with multiple communication partners subscribing to different wireless communication protocols.

2. Background Information

Advances in microprocessor and communication technology have led to the increase in popularlity of wireless communicaiton. Once confined to the privileged, wireless voice communication have become affordable and available to the masses. Today, various efforts are under way to apply wireless communication to replace attachment cables used for attaching peripheral devices, such as printers, scanners and the like, as well as networking cables used for connecting clients, servers and the like. A leading candidate to accomplish the former is commonly known to those skilled in the art as the Bluetooth technology or Bluetooth protocol. Examples of technology to accomplish the later include the different variants of the IEEE 802.11 Standard published by the Institute of Electrical and Electronic Engineers, 802.11 (Frequency Hoping and Direct Sequence), 802.11a, 802.11b as well as Home RF, also known as Shared Wireless Access Protocol (SWAP) to those skilled in the art.

A need has emerged in a number of applications that it is desirable for a devcie to be able to operate "concurrently" in multiple wirelss protocols. One such

applications is having a notebook computer being able to communicate with peripheral devices such as a phone, a printer, a scanner and the like, in accordance with the Bluetooth protocol; and with other computing devices, such as other peer computers or servers, communication devices, such as modems or adapters, and networking devices, such as gateways, routers, switches and the like, in accordance with one of the 802.11 protocols or Home RF.

However, the need cannot be met by simply providing the device with multiple transmitters, one for each protocol. The reason is because if multiple ones of these transmitters were to transmit at the same time. The transmitters are going to interfere with each other, resulting in corruption and/or loss of data, as well as degradation in performance.

As will be described in more detail below, the present invention substantially address this need in a very efficient and low cost manner. This and other advantages of the present invention will be readily apparent from the description to follow.

SUMMARY OF THE INVENTION

A wireless device is provided with a wireless transceiver having a joint signal transmit/receive section to transmit and receive signals wirelessly in accordance with a first and a second protocol. In one embodiment, the wireless device is further provided with a first and second up/down conversion pair to correspondingly up and down convert the transmit and receive signals in accordance with the two protocols. In an alternate embodiment, the wireless device is provided with a first and second down conversion unit to correspondingly down convert the receive signals, and a shared up conversion section to up convert transmit signals, in accordance with the two protocols. In either case, the wireless device is further provided with a controller/signal processing section to control and perform, in a coordinated manner, the transmit and receive operations in accordance with the two protocols.

In various embodiments, the wireless device is further provided with a processor programmed to implement a time sharing schedule to facilitate the coordinated control and performance of the transmit and receive operations. In some of these embodiments, the processor is further programmed to monitor the transmit and receive workloads of the two protocols and adaptively perform the coordinated control and signal processing, based at least in part on the observed workloads.

In various embodiments, the protocols may be selected pairs of Bluetooth, 802.11, 802.11a, 802.11b, Home RF and the like. The wireless device may also be used as a master device or a gateway device of two wireless networks.

BRIEF DESCRIPTION OF DRAWINGS

The present invention will be described by way of exemplary embodiments, but not limitations, illustrated in the accompanying drawings in which like references denote similar elements, and in which:

Figure 1 illustrates an overview of the wireless device of the present invention, in accordance with one embodiment;

Figure 2 illustrates a period of operation of the wireless device of the present invention, in accordance with one embodiment;

Figure 3 illustrates the transceiver of the wireless device of **Fig. 1** in further detail, in accordance with one implementation;

Figure 4 illustrates the signal processing subsection of controller/signal processing section of the wireless device of **Fig. 1** in further detail, in accordance with one implementation;

Figures 5a-5c illustrate the controller subsection of the controller/signal processing section of **Fig. 1** in further detail, in accordance with one implementation;

Figure 6 illustrates an overview of the present invention, in accordance with another embodiment;

Figure 7 illustrates the transceiver of the wireless device of **Fig. 6** in further detail, in accordance with one implementation; and

Figure 8 illustrates the controller subsection of the controller/signal processing section of **Fig. 6** in further detail, in accordance with one implementation.

DETAILED DESCRIPTION OF THE INVENTION

In the following description, various aspects of the present invention will be described. However, it will be apparent to those skilled in the art that the present invention may be practiced with only some or all aspects of the present invention. For purposes of explanation, specific numbers, materials and configurations are set forth in order to provide a thorough understanding of the present invention. However, it will also be apparent to one skilled in the art that the present invention may be practiced without the specific details. In other instances, well known features are omitted or simplified in order not to obscure the present invention.

Parts of the description will be presented using software terminology commonly employed by those skilled in the art to convey the substance of their work to others skilled in the art. As well understood by those skilled in the art, these software quantities take the form of electrical, magnetic, or optical signals capable of being stored, transferred, combined, and otherwise manipulated through mechanical and electrical components of a digital system; and the term digital system includes general purpose as well as special purpose processors, systems, and the like, that are standalone, adjunct or embedded.

Various operations will be described as multiple discrete steps performed in turn in a manner that is most helpful in understanding the present invention, however, the order of description should not be construed as to imply that these operations are necessarily order dependent, in particular, the order the steps are presented. Furthermore, the phrase "in one embodiment" will be used repeatedly, however the phrase does not necessarily refer to the same embodiment, although it may.

Referring now to **Figure 1**, wherein an overview of the present invention in accordance with one embodiment is shown. As illustrated, wireless device **100** is provided with wireless transceiver **102** of the present invention to transmit and receive signals wirelessly in accordance with a first and a second wireless communication protocol, in a coordinated manner, to enable device **100** to communicate with devices **104a** and devices **104b** of wireless networks **108a** and **108b**, at substantially the same time. Wireless transceiver **102** includes joint signal transmit/receive section **103**, and for the illustrated embodiment, a first and a second signal up/down conversion pairs **105a-105b** sharing joint signal transmit/receive section **103**. Wireless device **100** further includes controller/signal processing (C/SP) section **106** to process data for transmission by wireless transceiver **102**, to process signals received by wireless transceiver **102**, and to control the data/signal processing operations as well as the operation of wireless transceiver **102**.

In one embodiment, C/SP section **106** controls the data/signal processing operations and wireless transceiver **102** (hereinafter, simply transceiver), in a synchronized and coordinated fashion. More specifically, in this embodiment, C/SP section **106** controls the data/signal processing operations and transceiver **102** to alternate between transmits in a selected one of the two wireless communication protocols, and receives in both protocols. **Figure 2** illustrates a period of operation in accordance with this embodiment. As shown, in time period T1, for duration t1, C/SP section **106** operates joint signal transmit/receive section **103** and signal up/down conversion pairs **105a-105b** to perform transmit of signals to devices **104a** of wireless network **108a** (hereinafter, simply network) in accordance with the first wireless communication protocol (hereinafter, simply protocol), at the exclusion of devices **104b** of network **108b**. During this period, C/SP section **106** also

temporarily suspends processing of signals output from the signal down conversion sections of signal up/down conversion pairs **105a-105b**. In time period T3, for duration t3, the operation is performed for the second protocol. That is, C/SP section **106** operates joint signal transmit/receive section **103** and signal up/down conversion pairs **105a-105b** to perform transmit of signals to devices **104b** of network **108b** in accordance with the second protocol, at the exclusion of devices **104a** of network **108a**; and in like manner, temporarily suspends processing of signals output from the signal down conversion sections of signal up/down conversion pairs **105a-105b**. In time periods T2 and T4, for duration t2 and t4 respectively, C/SP section **106** processes signals output by the down conversion sections of both signal up/down conversion pairs **105a-105b** to receive signals from devices **104a** and **104b** of networks **108a** and **108b** in accordance with the respective protocols. During these time periods, C/SP section **106** temporarily suspends transmissions of signals to devices **104a** as well as devices **104b** of networks **108a** and **108b**.

Since all wireless protocols operate on either a carrier sense or contention free protocol, devices **104a** are able to receive in time period T1, and transmit when there are packets to transmit, but otherwise receive, in time periods T2-T4. Likewise, devices **104b** are able to receive in time period T3, and transmit when there are packets to transmit, but otherwise receive, in time periods T1-T2 and T4.

Accordingly, wireless device **100** is able to operate with devices **104a** and **104b** of networks **108a** and **108b** in two wireless protocols at the same time.

Note that time periods T1-T4 may or may not be equal in duration. That is, numerically t1-t4 may or may not be equal. As will be described in more detail below, in different variants of this embodiment, duration t1-t4 of time periods T1-T4 are dynamically and adaptively set. In particular, in some variants, duration t1-t4 of

time periods T1-T4 are adaptively set based at least in part of transmit and receive workloads of networks **108a** and **108b**.

Referring back to **Fig. 1**, except for the teachings of the present invention incorporated in wireless device **100** to effectuate the above described coordinated manner of operation of C/SP section **106**, joint signal transmit/receive section **103** and signal up/down conversion pairs **105a-105b** of transceiver **102**, C/SP section **106**, joint signal transmit/receive section **103** and signal up/down conversion pairs **105a-105b** of transceiver **102** are otherwise intended to represent a broad range of these elements known in the art. Accordingly, except for the teachings of the present invention, which will be further described below, transceiver **102** and C/SP section **106** will not be otherwise further described.

Wireless device **100** is intended to represent a wide range of devices that can benefit from having the ability to wirelessly operate with other wireless devices in two or more wireless communication protocols at the same time. Examples of device **100** include but not limited to computers of various form factors, such as desktop, notebook, palm size and so forth, controller devices (i.e. master devices) to manage and control the operation of networks **108a** and **108b**, and gateway devices to facilitate communication between devices **104a** and devices **104b**.

Likewise, devices **104a** and **104b** are intended to represent a broad range of devices that can benefit from being able to communicate wirelessly. Examples of devices **104a** include but not limited to phones, video cameras, speakers, modems, printers and scanners equipped to wireless communicate in accordance with the Bluetooth protocol. Examples of devices **104b** include clients and servers, as well as gateways, modems, hubs, routers, and switches equipped to wireless communicate in accordance with a selected variant of the IEEE 802.11 protocols or Home RF. In these example embodiments, joint signal transmit/receive section **103**

is a joint RF transmit/receive section, and each signal up/down conversion pair **105a/105b** is an IF up/down conversion pair.

For ease of understanding, only two groups of devices **104a** and **104b** communicating in accordance with the first and second wireless communication protocols (supported by two up/down conversion sections **105a-105b** in transceiver **102**) are shown in **Fig. 1**. However, from the description to follow, it will be readily apparent to those skilled in the art, the present invention may be practiced with more than two protocols, with employment of additional signal up/down conversion sections for the additional protocols, as long as they are likewise coordinated.

Referring now to **Figure 3**, wherein transceiver **102** is illustrated in further detail, in accordance with one implementation. As described earlier, transceiver **102** includes joint signal transmit/receive section **103**, and first and second signal up/down conversion pairs **105a-105b** sharing joint signal transmit/receive section **103**. As illustrated and alluded to earlier, joint signal transmit/receive section **103** is similarly constituted as prior art transmit/receive sections, with switch **302**, low noise amplifier (LNA) **304**, power amplifier (PA) **306** and filters **308a-308b** coupled to each other as shown. The functions and constitutions of these elements are known in the art. Each signal up/down conversion section **105a/105b** is also similarly constituted as in the prior art, with a signal up conversion subsection **316a/316b** and a signal down conversion subsection **314a/314b** for up and down conversion of signals of different frequencies of interest. Similarly, the functions and constitutions of these up and down conversion subsections are also known in the art. In one embodiment, joint transmit/receive section **103** is the earlier mentioned joint RF transmit/receive section that operates in a radio frequency, whereas first and second signal up/down

conversion pairs **105a/105b** are the earlier mentioned IF up/down conversion pairs that operate in intermediate frequencies.

In accordance with the present invention, down conversion subsections **314a-314b** of up/down conversion pairs **105a-105b** are coupled to joint signal transmit/receive section **103** in parallel, via splitter **310**. That is, receive signals output by filter **308a** are provided to both down conversion subsections **314a-314b** for down conversions in their respective frequencies of interest, allowing receive signals transmitted in different frequencies or protocols to be received at the same time. In the case of up conversion subsections **316a-316b** of up/down conversion pairs **105a-105b**, they are selectively coupled to joint signal transmit/receive section **103**, via switch **312**. That is, transmit signals from up conversion subsections **314a-314b** operating in their respective frequencies are selectively provided to filter **308b** to filter, in preparation for transmission, at the exclusion of the other, resulting in only signals from one frequency of interest (or protocol) being transmitted at any one point in time.

Referring now to **Figure 4**, wherein the signal processing subsection of C/SP section **106** is illustrated in further detail, in accordance with one implementation. As illustrated, signal processing subsection **402** of C/SP section **106** includes memory **402**, first and second receive signal processing blocks **404a-404b** for first and second protocols, first and second transmit data processing blocks **406a-406b** for first and second protocols, and A/D as well as D/A converters **408a-408b** and **410a-410b**. These elements perform their conventional functions known in the art, and their constitutions are protocol dependent, that is depending on the protocol they are designed/configured to support, e.g. an 802.11 variant or Bluetooth and so forth. A/D and D/A converters **408a-408b** and **410a-410b** convert analog signals

into digital signals, and digital signals to analog signals respectively. First and second receive signal processing blocks **404a-404b** process the digitized receive signals in accordance with their respective protocols to extract receive data, and store the extracted receive data in memory **402**. First and second transmit data processing blocks **406a-406b** process transmit data stored in memory **402** and package them for conversion and then transmission in accordance with first and second protocols respectively (e.g. adding headers, check sums and so forth). Except for the manner they are advantageously used to effectuate the substantially simultaneous communication with wireless devices in two protocols, these elements are otherwise known in the art. In one embodiment, receive and transmit signal processing blocks **404a** and **406a** process receive signals and package transmit data in accordance with a selected one of IEEE 802.11, 802.11a and 802.11b, and the Home RF protocol, whereas receive and transmit signal processing blocks **404b** and **406b** process receive signals and package transmit data in accordance with the Bluetooth protocol.

In an alternate embodiment, support for a selected one of IEEE 802.11, 802.11a and 802.11b, and the Home RF protocol may be dynamically selected. In this embodiment, multiple ones of receive and transmit signal processing blocks **404a** and **406a** are provided, and coupled to A/D and D/A converters **408a** and **410a** via a switching matrix.

Referring now to **Figures 5a-5c**, wherein controller subsection **500** of C/SP section **106** is illustrated in further detail, in accordance with one implementation. As illustrated in **Fig. 5a**, controller subsection **500** includes processor **502** and memory **504**. Stored in memory **504** are programming instructions **506** to be executed by processor **502** to effectuate the earlier describe control of the receive

and transmit processing operations of the signal processing subsection of C/SP section **106** and transceiver **102** for the time sharing mode of operation as set forth referencing **Fig. 2**.

As illustrated in **Fig. 5b**, at **512**, processor **502** (executing programming instructions **506**) causes signal up conversion subsection **314a** of first signal up/down conversion pair **105a** to be coupled to joint signal transmit/receive section **103** at the exclusion of signal up conversion subsection **314b** of first signal up/down conversion pair **105b**. At the same time, processor **502** causes receive signal processing blocks **404a** and **404b** to temporarily ignore or suspend processing signals output by down conversion subsections **314a-314b**. At **514**, processor **502** repeatedly determines if it has operated in this mode for a sufficient duration, i.e. if elapsed time for period T1 has reached t1. Eventually, upon determining it has operated in this mode for the appropriate duration, the process continues at **516**.

At **516**, processor **502** causes signal up conversion subsections **314a-314b** of both first and second signal up/down conversion pairs **105a-105b** to be de-coupled from joint signal transmit/receive section **103**, thereby preventing signals to be transmitted under either protocol. Furthermore, processor **502** causes receive signal processing blocks **404a** and **404b** to resume processing signals output by down conversion subsections **314a-314b**, thereby allowing signals received in both protocols to be processed and received at the same time. At **518**, processor **502** repeatedly determines if it has operated in this mode for a sufficient duration, i.e. if elapsed time for period T2 has reached t2. Eventually, upon determining it has operated in this mode for the appropriate duration, the process continues at **520**.

At **520**, processor **502** causes signal up conversion subsection **314b** of second signal up/down conversion pair **105b** to be coupled to joint signal transmit/receive section **103** at the exclusion of signal up conversion subsection

314a of first signal up/down conversion pair **105a**. At the same time, processor **502** causes receive signal processing blocks **404a** and **404b** to temporarily ignore or suspend processing signals output by down conversion subsections **314a-314b**. At **522**, processor **502** repeatedly determines if it has operated in this mode for a sufficient duration, i.e. if elapsed time for period T3 has reached t3. Eventually, upon determining it has operated in this mode for the appropriate duration, the process continues at **524** and **526**.

At **524** and **526** processor performs the same functions as earlier described for **516** and **518**. Eventually, upon determining it has operated in this mode for period T4 for time t4, the process continues at **512**.

Referring back to **Fig. 5a**, for the illustrated embodiment, memory **504** is also used to store the duration values t1-t4, allowing the length of periods T1-T4 to be programmable. Furthermore, as described in below and illustrated in **Fig. 5c**, programming instructions **506** are also equipped to adaptively adjusted these values. Referring now to **Fig. 5c**, at **532-534**, processor monitors for transmit and receive packets of each protocol, and upon detection, updates two workload counters, one for each of the protocols, accordingly. At **536**, processor determines if the period for monitoring has elapsed. The period may be pre-programmed or provided through e.g. a programmable configuration register (not shown). Operations **532-534** are repeated until the monitoring period has expired. At such time, the process continues at **538**, where processor **502** analyzes the cumulated workload data for the two protocols, and adaptively adjusted the duration values t1-t4 for periods T1-T4, based at least in part on the observed workloads for the two protocols. The adjustment may be made in a straight forward proportional manner, or employing any one of a number of heuristic approaches.

Upon making the adjustment, in one embodiment, processor **502** resumes the monitoring immediately. In an alternate embodiment, processor **502** resumes the monitoring after waiting a pre-determined or dynamically determined period of time. Alternatively, it may also resume only upon invoked to do so.

Referring now to **Figure 6**, wherein an overview of the present invention in accordance with an alterante embodiment is shown. As illustrated, similar to the embodiment earlier described referencing **Fig. 1**, wireless device **100'** is provided with wireless transceiver **102'** of the present invention to transmit and receive signals wirelessly in accordance with a first and a second wireless communication protocol, in a coordinated manner, to enable device **100'** to communicate with devices **104a** and devices **104b** of wireless networks **108a** and **108b**, at substantially the same time. Similar to the embodiment of **Fig. 1**, wireless transceiver **102'** includes joint signal transmit/receive section **103**. However, unlike the embodiment of **Fig. 1**, wireless device **100'** is provided with a first and a second signal down conversion section **105c-105d** and a common signal up conversion unit **105e**, sharing joint signal transmit/receive section **103**. Wireless device **100'**, as the embodiment of **Fig. 1**, further includes controller/signal processing (C/SP) section **106** to process data for transmission by wireless transceiver **102'**, to process signals received by wireless transceiver **102'**, and to control the data/signal processing operations as well as the operation of wireless transceiver **102'**. In one embodiment, C/SP section **106** controls the data/signal processing operations and wireless transceiver **102'**, in a synchronized and coordinated fashion, as described earlier.

Figure 7 illustrates transceiver **102'** in further detail, in accordance with one implementation. Joint signal transmit/receive section **103** is similarly constituted as

earlier described. Each signal down conversion section **105c/105d** is also similarly constituted as in the prior art, and functions as earlier described signal down conversion subsection **314a/314b**. Common signal up conversion section **105e** serves the functions of both signal up conversion subsections **316a** and **316b**.

As earlier described, down conversion sections **105c-105d** are coupled to joint signal transmit/receive section **103** in parallel, via splitter **310**. That is, receive signals output by filter **308a** are provided to both down conversion sections **105c-105d** for down conversions in their respective frequencies of interest, allowing receive signals transmitted in different frequencies or protocols to be received at the same time. In the case of common up conversion sections **105e**, it is selectively coupled to the transmit signal processing sections of C/SP **106**, via switch **312**. That is, transmit signals of the two protocols are provided to filter **308b** through up conversion section **105e** operating in one of two frequencies, at the exclusion of the other, for preparation for transmission, resulting in only signals from one frequency of interest (or protocol) being transmitted at any one point in time.

C/SP **106** is similarly constituted as earlier described referencing **Fig. 4**, including controller subsection **500**, which is constituted as earlier described referencing **Fig. 5a**. However, the operational flow of controller subsection **500** under this alternate embodiment is slightly different, which is illustrated in **Fig. 8**.

At **812**, processor **502** (executing programming instructions **506**) causes signal up conversion section **105e** to be coupled to transmit signal processing subsection **406b** of signal processing section **400** (for the first protocol), at the exclusion of transmit signal processing subsection **406a** (for the second protocol). At the same time, processor **502** causes receive signal processing blocks **404a** and **404b** to temporarily ignore or suspend processing signals output by down conversion subsections **105c-105d**. At **814**, processor **502** repeatedly determines if

it has operated in this mode for a sufficient duration, i.e. if elapsed time for period T1 has reached t1. Eventually, upon determining it has operated in this mode for the appropriate duration, the process continues at **816**.

At **816**, processor **502** causes signal up conversion section **105e** to be de-coupled from both transmit signal processing subsections **406a** and **406b** of signal processing section **400**, thereby preventing signals to be transmitted under either protocol. Furthermore, processor **502** causes receive signal processing blocks **404a** and **404b** to resume processing signals output by down conversion sections **105c-105d**, thereby allowing signals received in both protocols to be processed and received at the same time. At **818**, processor **502** repeatedly determines if it has operated in this mode for a sufficient duration, i.e. if elapsed time for period T2 has reached t2. Eventually, upon determining it has operated in this mode for the appropriate duration, the process continues at **820**.

At **820**, processor **502** causes signal up conversion section **105e** to be coupled to transmit signal processing subsection **406a** of signal processing section **400** (for the second protocol), at the exclusion of transmit signal processing subsection **406b** (for the first protocol). At the same time, processor **502** causes receive signal processing blocks **404a** and **404b** to temporarily ignore or suspend processing signals output by down conversion sections **105c-105d**. At **822**, processor **502** repeatedly determines if it has operated in this mode for a sufficient duration, i.e. if elapsed time for period T3 has reached t3. Eventually, upon determining it has operated in this mode for the appropriate duration, the process continues at **824** and **826**.

At **824** and **826** processor performs the same functions as earlier described for **816** and **818**. Eventually, upon determining it has operated in this mode for period T4 for time t4, the process continues at **812**.

Thus, a wireless device equipped to substantially operate currently with multiple wireless communication protocols has been described. While the present invention has been described in terms of the above illustrated embodiments, those skilled in the art will recognize that the invention is not limited to the embodiments described. The present invention can be practiced with modification and alteration within the spirit and scope of the appended claims. The description is thus to be regarded as illustrative instead of restrictive on the present invention.

CLAIMS

What is claimed is:

1. An apparatus comprising:

a wireless transceiver having a joint signal transmit/receive section, and a plurality of signal up/down conversion sections sharing said joint signal transmit/receive section, to transmit and receive signals in accordance with a first and a second protocol, in a coordinated manner, to and from network devices of a first and a second wireless network; and

a controller coupled to the wireless transceiver to control said wireless transceiver to perform said transmits and receives in said coordinated manner.

2. The apparatus of claim 1, wherein the controller, in a coordinated manner, selectively couples a first signal up conversion section to the joint signal transmit/receive section to perform said transmit of signals to network device(s) of said first wireless network, while keeping a second signal up conversion section de-coupled from the joint signal transmit/receive section preventing signals from being transmitted to network device(s) of said second wireless network.

3. The apparatus of claim 2, wherein the controller further, in a coordinated manner, selectively couples a second signal up conversion section to the joint signal transmit/receive section to perform said transmit of signals to network device(s) of said second wireless network, while keeping the first signal up conversion section de-coupled from the joint signal transmit/receive section preventing signals from being transmitted to network device(s) of said first wireless network.

4. The apparatus of claim 1, wherein the controller, in a coordinated manner, selectively de-couples both a first and a second signal up conversion section from the joint signal transmit/receive section to prevent signals from being transmitted to network devices of said first and second networks.

5. The apparatus of claim 1, wherein the apparatus further comprises a signal processing section coupled to said wireless transceiver and said controller to process data for transmission by said wireless transceiver to said network devices of said wireless networks, and to process signals received by said wireless transceiver from said network devices of said wireless networks, in a coordinated manner, under the control of said controller.

6. The apparatus of claim 5, wherein the controller enables the signal processing section to simultaneously process signals received from network devices of said wireless networks, and down converted by signal down conversion sections of the wireless transceiver, and stops the signal processing section from processing signals output by said down conversion sections of the wireless transceiver.

7. The apparatus of claim 1, wherein the controller controls the wireless transceiver to perform said transmits and receives in a coordinated manner, in accordance with a time sharing schedule.

8. The apparatus of claim 7, wherein the controller comprises a processor adapted to control the wireless transceiver in a first transmit mode for the first

protocol, a second transmit mode for the second protocol, and a joint receive mode for both protocols, in accordance with the time sharing schedule.

9. The apparatus of claim 8, wherein the processor is further adapted to adaptively manage the time sharing schedule.

10. The apparatus of claim 9, wherein the processor is further adapted to adaptively manage the time sharing schedule based at least in part on transmit or receive workloads of said first and second wireless networks.

11. The apparatus of claim 10, wherein the processor is further adapted to monitor and track transmit or receive workloads of said first and second wireless networks.

12. The apparatus of claim 1, wherein the first and the second protocol are two protocols selected from a group consisting of Bluetooth, 802.11, 802.11a, 802.11b, and Home RF.

13. The apparatus of claim 1, wherein the joint signal transmit/receive section is a joint RF transmit/receive section, and the plurality of signal up/down conversion pairs are IF up/down conversion sections.

14. The apparatus of claim 1, wherein the apparatus is a computer having a form factor selected from a group consisting of a desktop type, a notebook type and a palm sized type.

15. The apparatus of claim 1, wherein the controller further comprises a first and a second transmit signal processing section to processing transmit data for transmission in accordance with the first and second protocols, and the controller, in a coordinated manner, selectively couples a signal up conversion section to the first transmit signal processing section to perform said transmit of signals to network device(s) of said first wireless network, while keeping the second transmit signal processing section de-coupled from the signal up conversion section, preventing signals from being transmitted to network device(s) of said second wireless network.

16. The apparatus of claim 15, wherein the controller further, in a coordinated manner, selectively couples the signal up conversion section to the second transmit signal processing section to perform said transmit of signals to network device(s) of said second wireless network, while keeping the signal up conversion section de-coupled from the first transmit signal processing section, preventing signals from being transmitted to network device(s) of said first wireless network.

17. In an apparatus having a wireless transceiver including a joint signal transmit/receive section, and a plurality of signal up/down conversion sections sharing the joint signal transmit/receive section, a method of operation comprising:

(a) coupling a first signal up conversion section to the joint signal transmit/receive section to perform transmit of signals to network device(s) of a first wireless network in accordance with a first protocol, while keeping a second signal up conversion section de-coupled from the joint signal transmit/receive section to prevent signals from being transmitted to network device(s) of a second wireless network in accordance with a second protocol; and

(b) coupling the second signal up conversion section to the joint signal transmit/receive section to perform transmit of signals to network device(s) of the second wireless network in accordance with the second protocol, while keeping the first signal up conversion section de-coupled from the joint signal transmit/receive section to prevent signals from being transmitted to network device(s) of the first wireless network in accordance with the first protocol.

18. The method of claim 17, wherein

the apparatus further comprises a signal processing section coupled to said wireless transceiver to process data for transmission by said wireless transceiver to said network devices of said wireless networks, and to process signals received by said wireless transceiver from said network devices of said wireless networks, in a coordinated manner; and

the method further comprises enabling the signal processing section to simultaneously process signals received from said network devices of said wireless networks, and down converted by signal down conversion sections of the wireless transceiver, and stops the signal processing section from processing signals output by said down conversion sections of the wireless transceiver.

19. The method of claim 17, wherein the method further comprises (c) adjusting performance repetition of (a) and (b).

20. The method of claim 19, wherein (c) is performed adaptively based at least in part on transmit or receive workloads of the first and second networks.

21. The method of claim 20, wherein the method further comprises (d) monitoring transmit or receive workloads of said first and second networks.

22. In an apparatus having a wireless transceiver including a plurality of signal up/down conversion sections, and a controlling section having a first and a second transmit signal processing section, a method of operation comprising:

(a) coupling a signal up conversion section to a first transmit signal processing section to perform transmit of signals to network device(s) of a first wireless network in accordance with a first protocol, while keeping the signal up conversion section de-coupled from a second transmit signal processing section to prevent signals from being transmitted to network device(s) of a second wireless network in accordance with a second protocol; and

(b) coupling the signal up conversion section to the second transmit signal processing section to perform transmit of signals to network device(s) of the second wireless network in accordance with the second protocol, while keeping the signal up conversion section de-coupled from the first transmit signal processing section to prevent signals from being transmitted to network device(s) of the first wireless network in accordance with the first protocol.

23. A collection of apparatuses comprising:

a first apparatus equipped to communicate wirelessly in accordance with a first protocol;

a second apparatus equipped to communicate wirelessly in accordance with a second protocol; and

a third apparatus equipped to communicate wirelessly with said first and second apparatuses in accordance with said first and second protocols respectively,

as well as equipped to automatically coordinate transmit and receive operations conducted in accordance with said two protocols to enable the third apparatus to operate with said first and second apparatuses at the same time.

24. The collection of apparatuses of claim 23, wherein the third apparatus is further equipped to perform said automatic coordination of transmit and receive operations conducted in accordance with said two protocols in an adaptive manner, based at least in part on transmit or receive workloads of the two protocols.

25. The collection of apparatuses of claim 24, wherein the third apparatus is further equipped to monitor transmit or receive workloads of the two protocols.

26. A collection of networked apparatuses comprising:

a first plurality of apparatuses wirelessly networked together, with each apparatus being equipped to communicate wirelessly in accordance with a first protocol;

a second plurality of apparatuses wirelessly networked together, with each apparatus being equipped to communicate wirelessly in accordance with a second protocol; and

a master apparatus equipped to communicate wirelessly with said first and second plurality of apparatuses in accordance with said first and second protocols respectively, as well as equipped to automatically coordinate transmit and receive operations conducted in accordance with said two protocols to enable the master apparatus to manage and control said first and second plurality of apparatuses at the same time.

27. The collection of networked apparatuses of claim 26, wherein the master apparatus is further equipped to perform said automatic coordination of transmit and receive operations conducted in accordance with said two protocols in an adaptive manner, based at least in part on transmit or receive workloads of the two protocols.

28. The collection of networked apparatuses of claim 27, wherein the master apparatus is further equipped to monitor transmit or receive workloads of the two protocols.

29. A collection of networked apparatuses comprising:

a first plurality of apparatuses wirelessly networked together, with each apparatus being equipped to communicate wirelessly in accordance with a first protocol;

a second plurality of apparatuses wirelessly networked together, with each apparatus being equipped to communicate wirelessly in accordance with a second protocol; and

a gateway apparatus equipped to communicate wirelessly with said first and second plurality of apparatuses in accordance with said first and second protocols respectively, as well as equipped to automatically coordinate transmit and receive operations conducted in accordance with said two protocols to enable the gateway apparatus to facilitate communication between said first plurality of apparatuses and said second plurality of apparatuses.

30. The collection of networked apparatuses of claim 29, wherein the gateway apparatus is further equipped to perform said automatic coordination of transmit and

receive operations conducted in accordance with said two protocols in an adaptive manner, based at least in part on transmit or receive workloads of the two protocols.

31. The collection of networked apparatuses of claim 30, wherein the gateway apparatus is further equipped to monitor transmit or receive workloads of the two protocols.

ABSTRACT OF THE DISCLOSURE

A wireless device is provided with a wireless transceiver having a joint signal transmit/receive section, and a number of signal up/down conversion sections to transmit and receive signals wirelessly in accordance with a first and a second protocol. The wireless device is further provided with a controller/signal processing section to control and perform, in a coordinated manner, the transmit and receive operations in accordance with the two protocols. In various embodiments, the wireless device is further provided with a processor programmed to implement a time sharing schedule to facilitate the coordinated control and performance of the transmit and receive operations. In some of these embodiments, the processor is further programmed to monitor the transmit and receive workloads of the two protocols and adaptively perform the coordinated control and signal processing, based at least in part on the observed workloads. In various embodiments, the protocols may be selected pairs of Bluetooth, 802.11, 802.11a, 802.11b, Home RF and the like. The wireless device may also be used as a master device or a gateway device of two wireless networks.

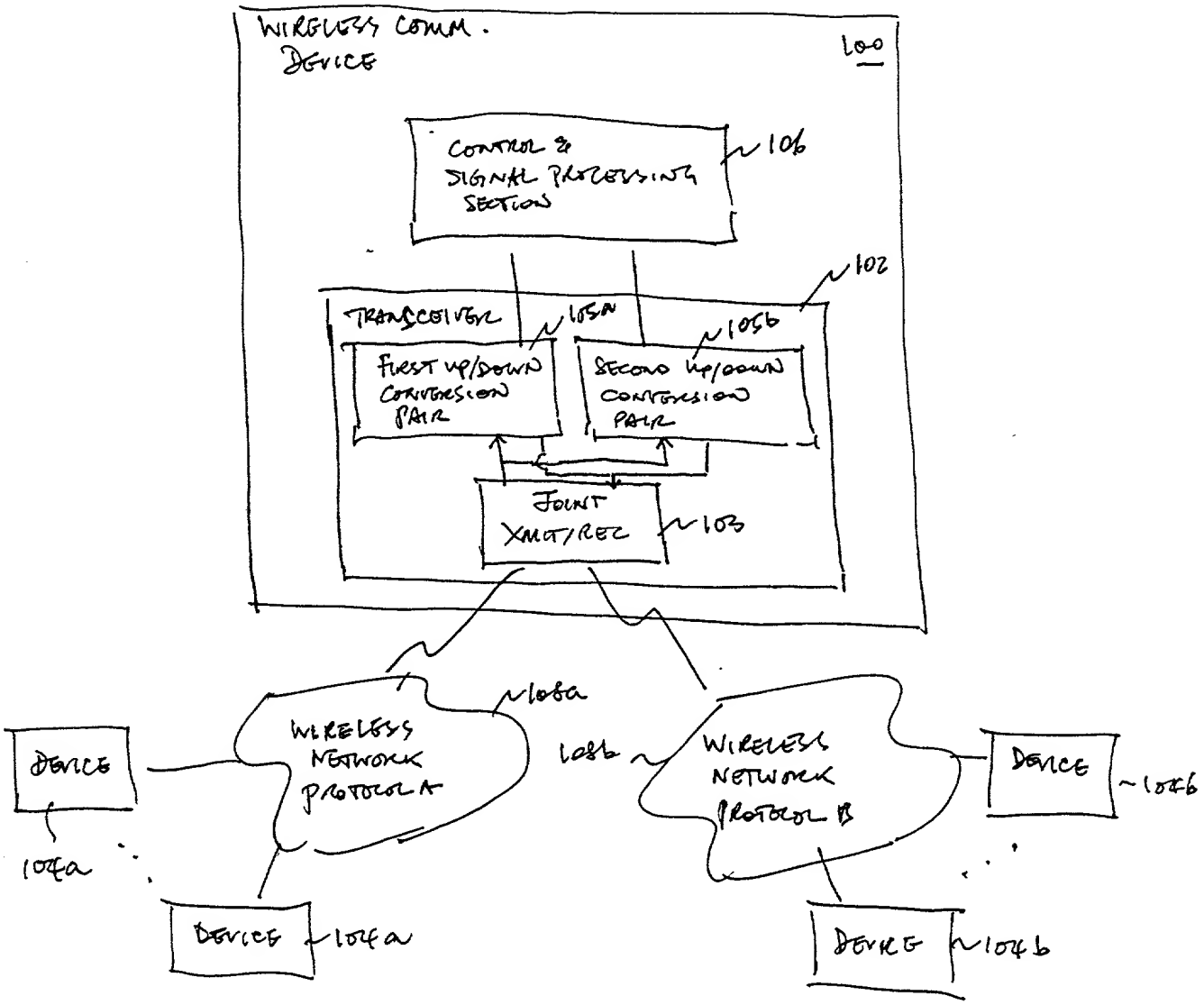
WIRELESS COMM. DEVICE
100
CONTROL & SIGNAL PROCESSING SECTION
106
102
TRANSCEIVER
105A
105B
FIRST UP/DOWN CONVERSION PAIR
SECOND UP/DOWN CONVERSION PAIR
JOINT XMIT/REC
103
WIRELESS NETWORK PROTOCOL A
104a
WIRELESS NETWORK PROTOCOL B
104b
DEVICE
104a
DEVICE
104a
DEVICE
104b
DEVICE
104b

FIG. 1

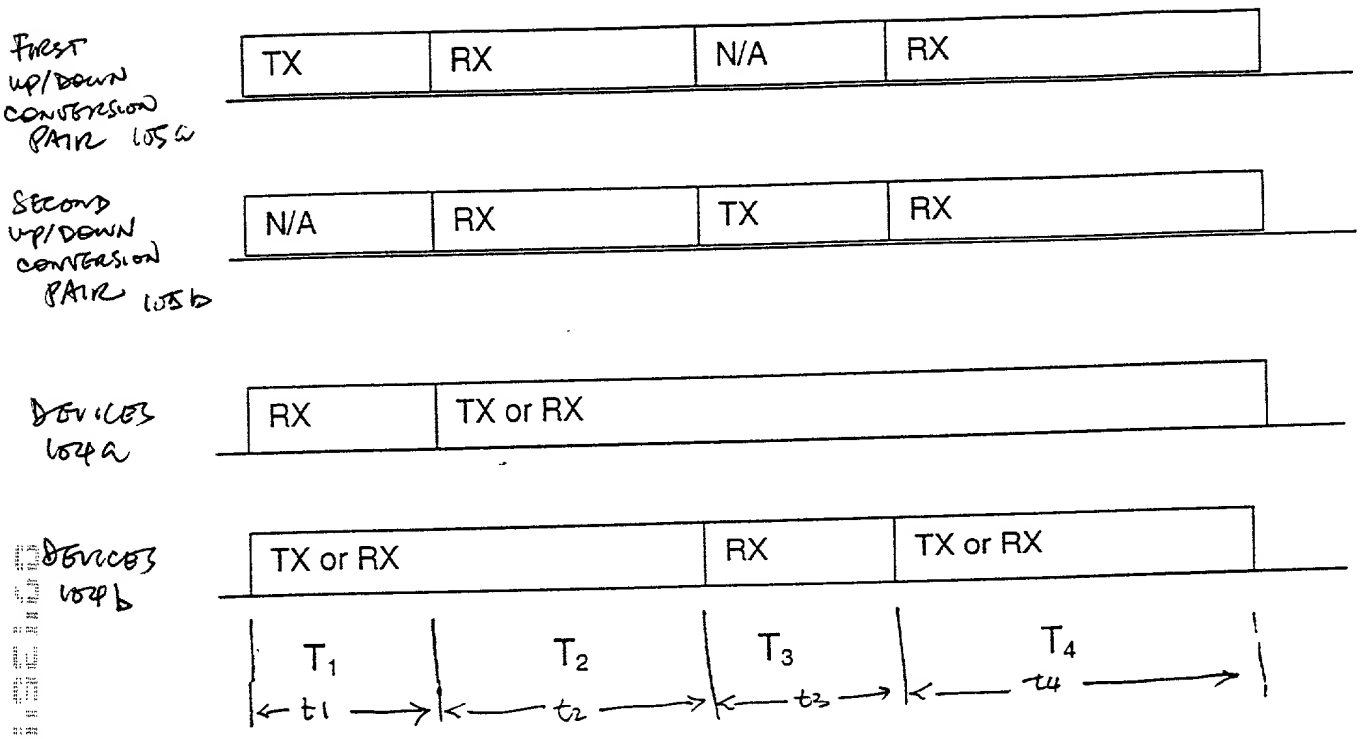
FIRST UP/DOWN CONVERSION PAIR 105a
TX
RX
N/A
RX
SECOND UP/DOWN CONVERSION PAIR 105b
N/A
RX
TX
RX
DEVICES 104a
RX
TX or RX
DEVICES 104b
TX or RX
RX
TX or RX
T1
T2
T3
T4
t1
t2
t3
t4

FIG. 2

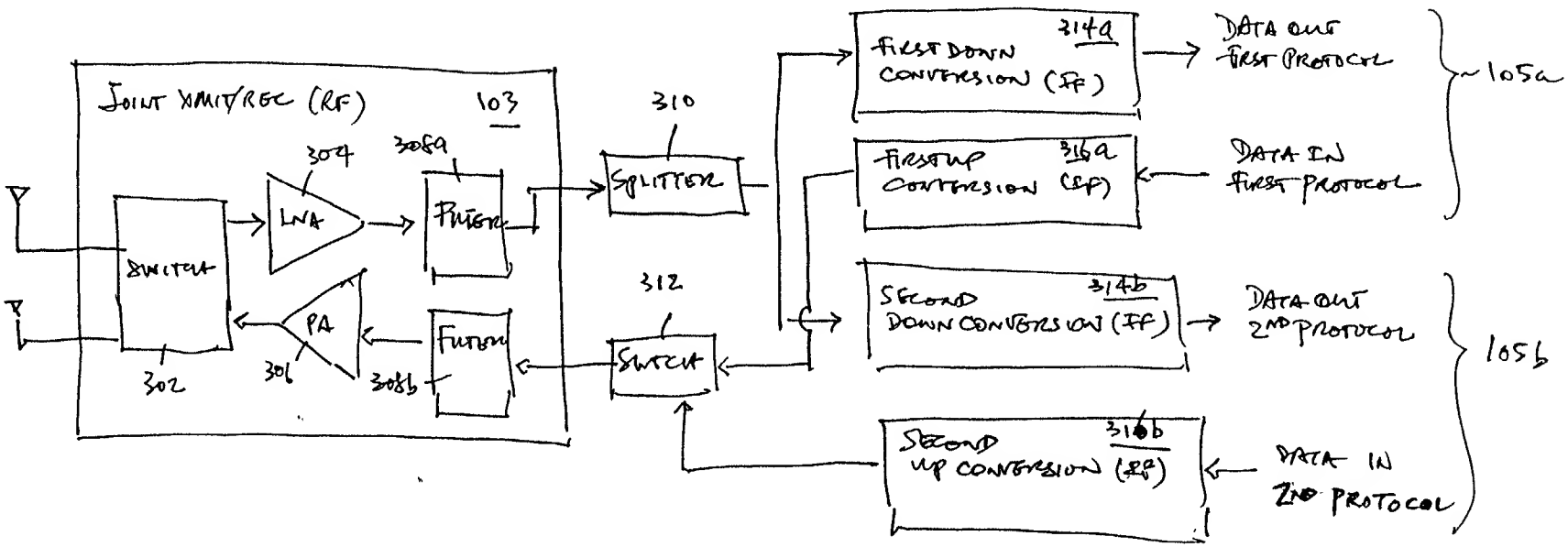
JOINT XMIT/REC (RF)
103
SWITCH
302
LNA
304
PA
306
FILTER
308a
FILTER
308b
SPLITTER
310
SWITCH
312
FIRST DOWN CONVERSION (IF)
314a
SECOND DOWN CONVERSION (IF)
314b
FIRST UP CONVERSION (IF)
316a
SECOND UP CONVERSION (IF)
316b
DATA OUT FIRST PROTOCOL
DATA IN FIRST PROTOCOL
DATA OUT 2ND PROTOCOL
DATA IN 2ND PROTOCOL
105a
105b

FIG. 3

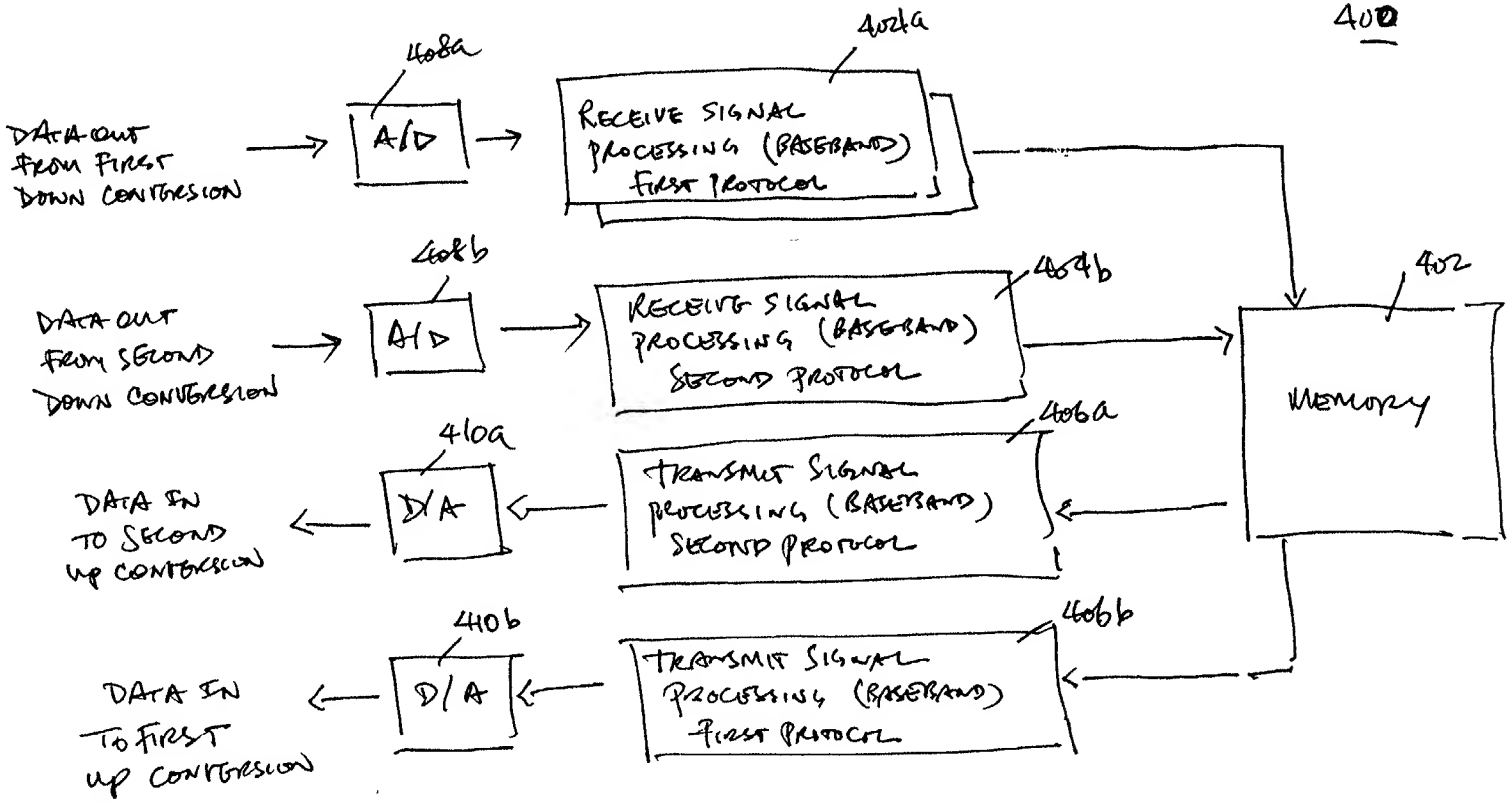
400
402
402a
RECEIVE SIGNAL PROCESSING (BASEBAND) FIRST PROTOCOL
408a
A/D
DATA OUT FROM FIRST DOWN CONVERSION
402b
RECEIVE SIGNAL PROCESSING (BASEBAND) SECOND PROTOCOL
408b
A/D
DATA OUT FROM SECOND DOWN CONVERSION
MEMORY
404a
TRANSMIT SIGNAL PROCESSING (BASEBAND) SECOND PROTOCOL
410a
D/A
DATA IN TO SECOND UP CONVERSION
404b
TRANSMIT SIGNAL PROCESSING (BASEBAND) FIRST PROTOCOL
410b
D/A
DATA IN TO FIRST UP CONVERSION

Fig. 4

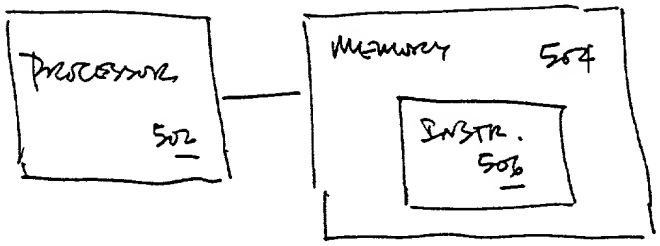
PROCESSOR
502
MEMORY
504
INSTR.
506
500

Fig. 5a

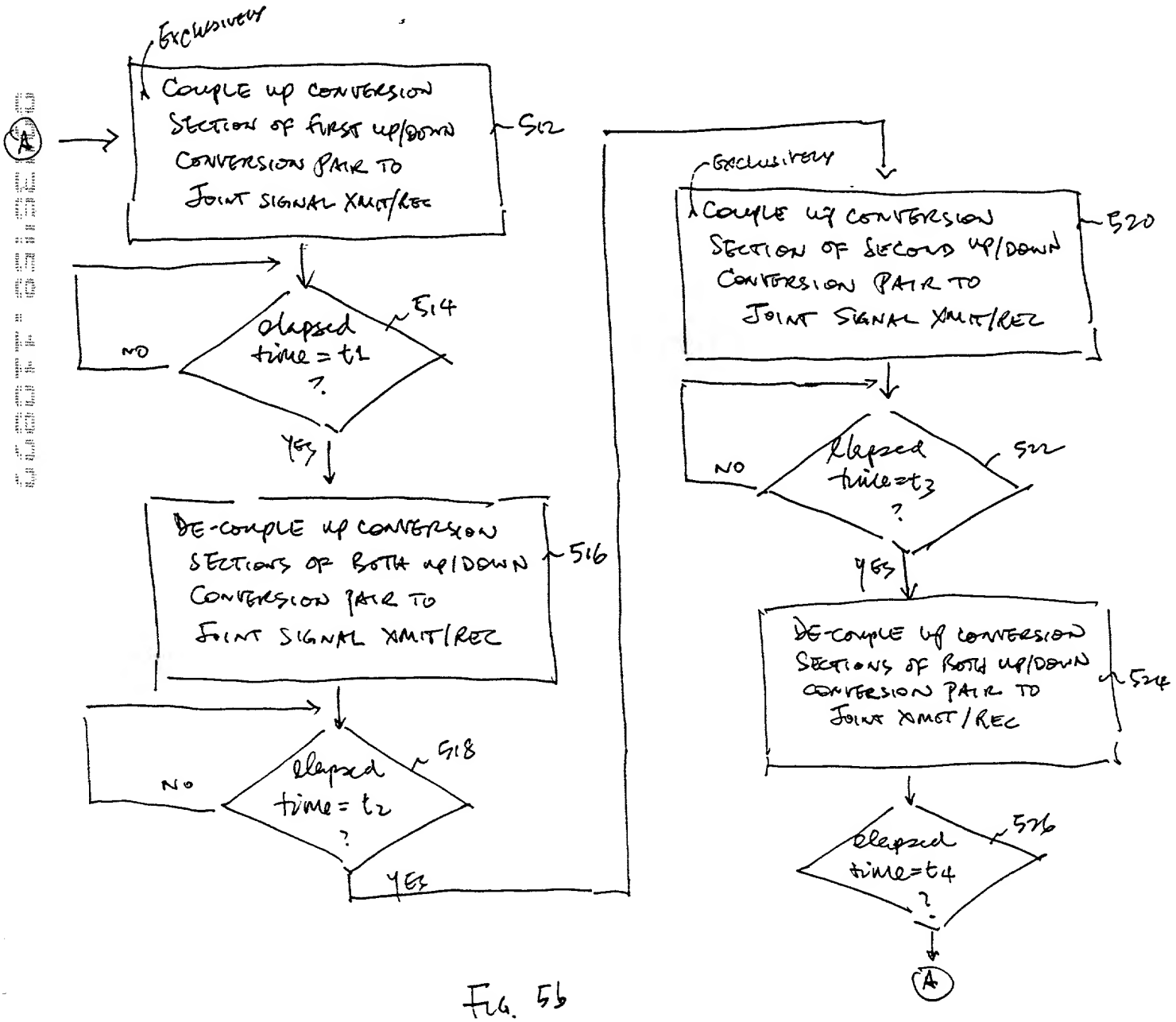
EXCLUSIVELY
COUPLE UP CONVERSION SECTION OF FIRST UP/DOWN CONVERSION PAIR TO JOINT SIGNAL XMIT/REC
512
ELAPSED TIME = t1 ?
514
NO
YES
DE-COUPLE UP CONVERSION SECTIONS OF BOTH UP/DOWN CONVERSION PAIR TO JOINT SIGNAL XMIT/REC
516
ELAPSED TIME = t2 ?
518
NO
YES
EXCLUSIVELY
COUPLE UP CONVERSION SECTION OF SECOND UP/DOWN CONVERSION PAIR TO JOINT SIGNAL XMIT/REC
520
ELAPSED TIME = t3 ?
522
NO
YES
DE-COUPLE UP CONVERSION SECTIONS OF BOTH UP/DOWN CONVERSION PAIR TO JOINT XMIT/REC
524
ELAPSED TIME = t4 ?
526
A
A

Fig. 5b

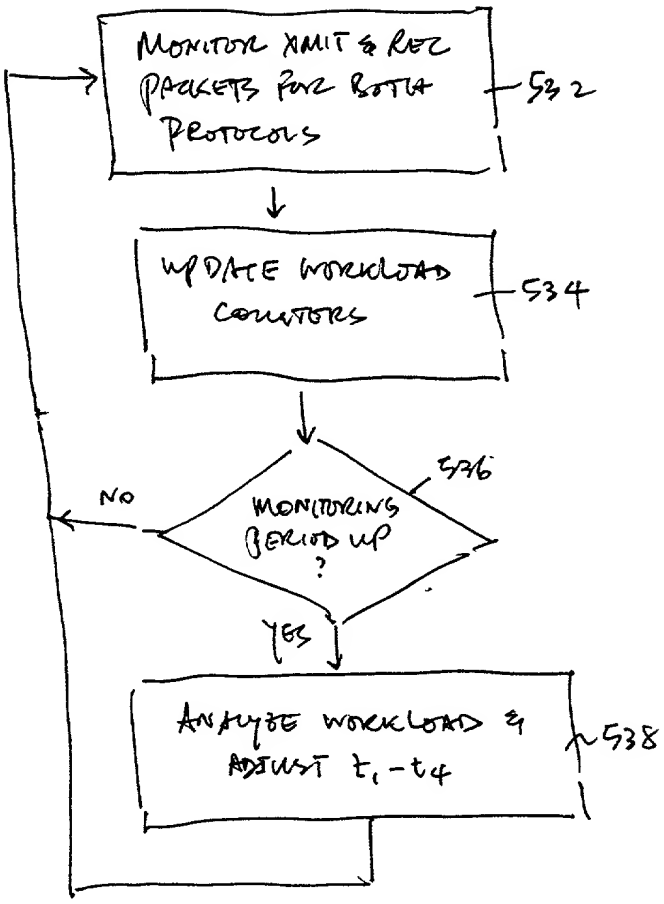
MONITOR XMIT & REC PACKETS FOR BOTH PROTOCOLS
532
UPDATE WORKLOAD COUNTERS
534
MONITORING PERIOD UP ?
536
NO
YES
ANALYSE WORKLOAD & ADJUST $t_1 - t_4$
538

Fig. 5C

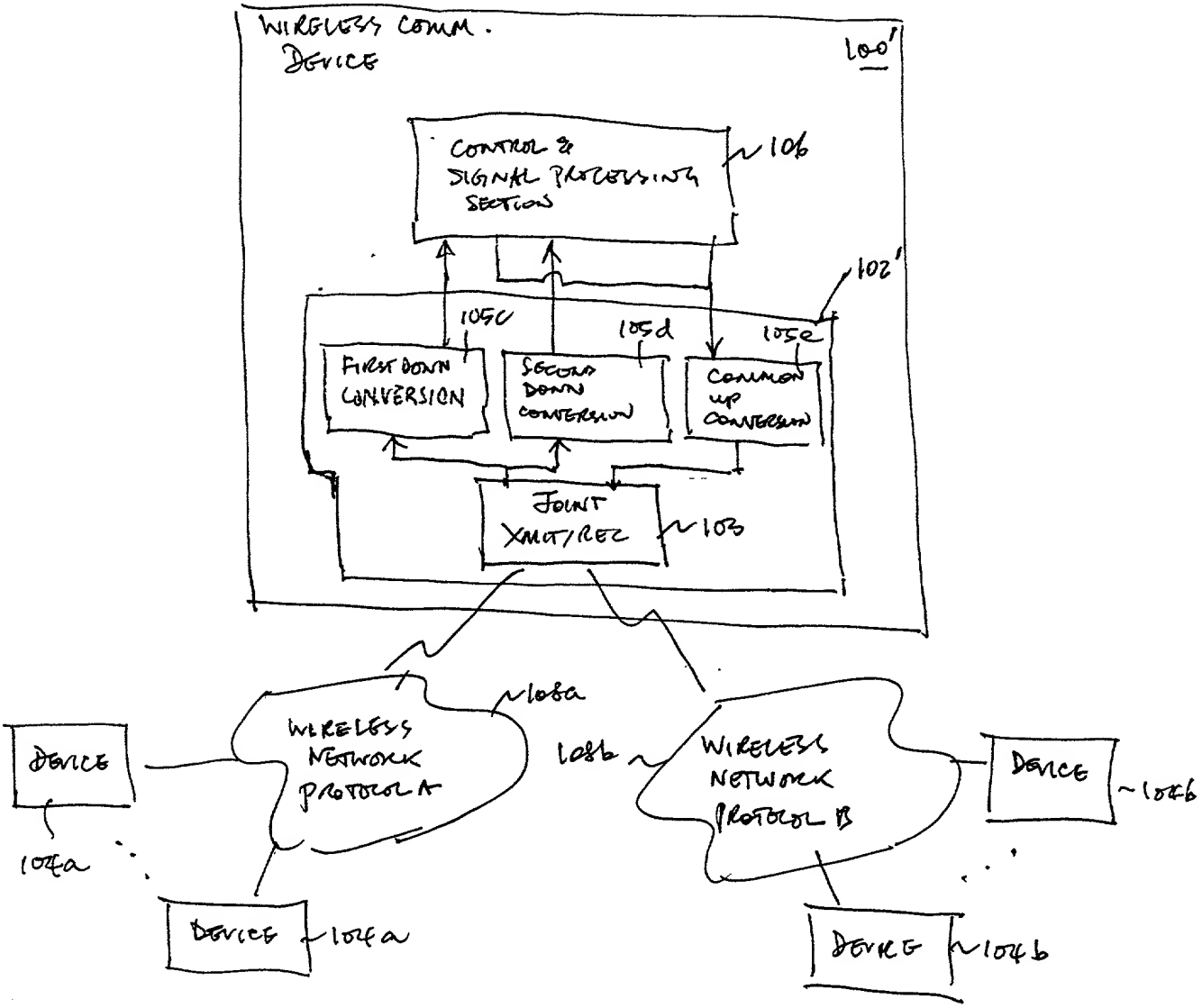
WIRELESS COMM. DEVICE
100'
CONTROL & SIGNAL PROCESSING SECTION
106
102'
105c
105d
105e
FIRST DOWN CONVERSION
SECOND DOWN CONVERSION
COMMON UP CONVERSION
JOINT XMIT/REC
103
108a
108b
WIRELESS NETWORK PROTOCOL A
WIRELESS NETWORK PROTOCOL B
DEVICE
104a
DEVICE
104a
DEVICE
104b
DEVICE
104b

FIG. 6

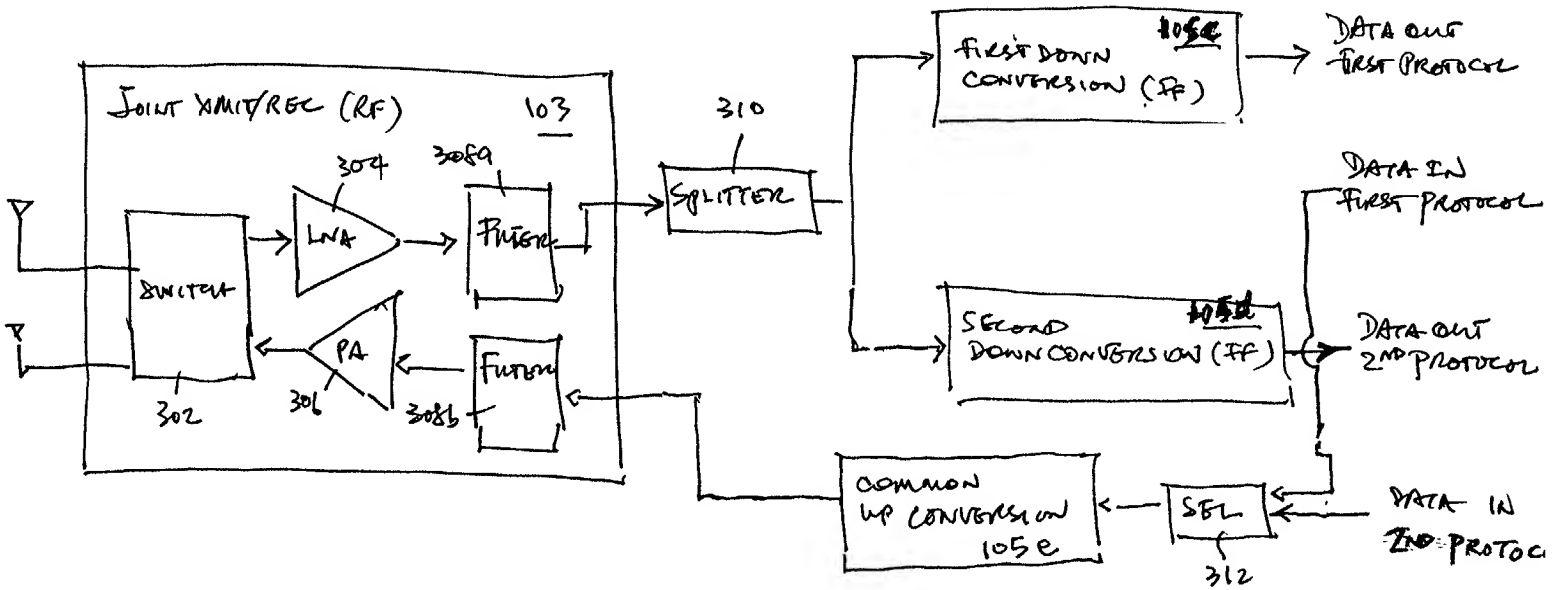
JOINT XMIT/REC (RF)
103
SWITCH
302
LNA
304
PA
306
FILTER
308a
FILTER
308b
SPLITTER
310
FIRST DOWN CONVERSION (IF)
105c
SECOND DOWN CONVERSION (IF)
105d
COMMON UP CONVERSION
105e
SEL
312
DATA OUT FIRST PROTOCOL
DATA IN FIRST PROTOCOL
DATA OUT 2ND PROTOCOL
DATA IN 2ND PROTOC

FIG. 7

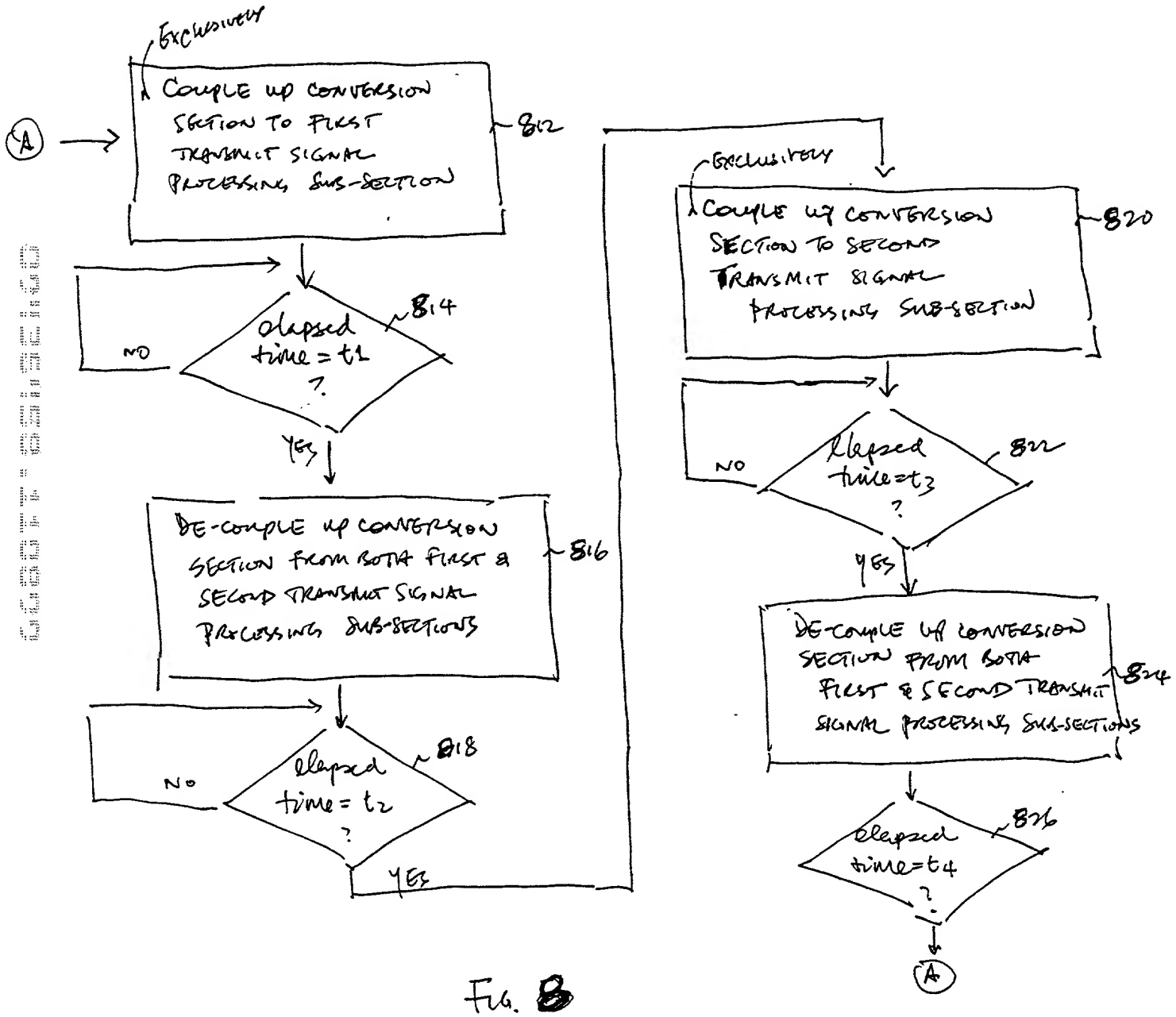
A
EXCLUSIVELY
COUPLE UP CONVERSION SECTION TO FIRST TRANSMIT SIGNAL PROCESSING SUB-SECTION
812
elapsed time = t1 ?
814
NO
YES
DE-COUPLE UP CONVERSION SECTION FROM BOTH FIRST & SECOND TRANSMIT SIGNAL PROCESSING SUB-SECTIONS
816
elapsed time = t2 ?
818
NO
YES
EXCLUSIVELY
COUPLE UP CONVERSION SECTION TO SECOND TRANSMIT SIGNAL PROCESSING SUB-SECTION
820
elapsed time = t3 ?
822
NO
YES
DE-COUPLE UP CONVERSION SECTION FROM BOTH FIRST & SECOND TRANSMIT SIGNAL PROCESSING SUB-SECTIONS
824
elapsed time = t4 ?
826
A

Fig. 8

Attorney's Docket No.: 04198.P003 PATENT

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below, next to my name.

I believe I am the original, first, and sole inventor (if only one name is listed below) or an original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

A WIRELESS APPARATUS HAVING A TRANSCEIVER EQUIPPED TO SUPPORT MULTIPLE WIRELESS COMMUNICATION PROTOCOLS

the specification of which

XX is attached hereto.
___ was filed on _____ as
United States Application Number _____
or PCT International Application Number _____
and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment referred to above.

I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d), of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)			Priority Claimed	
(Number)	(Country)	(Day/Month/Year Filed)	Yes	No
(Number)	(Country)	(Day/Month/Year Filed)	Yes	No
(Number)	(Country)	(Day/Month/Year Filed)	Yes	No

I hereby claim the benefit under title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below

(Application Number)	Filing Date

(Application Number) Filing Date

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Number)	Filing Date	(Status -- patented, pending, abandoned)
(Application Number)	Filing Date	(Status -- patented, pending, abandoned)

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Send correspondence to Aloysius T.C. AuYeung (Name of Attorney or Agent), BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP, 12400 Wilshire Boulevard 7th Floor, Los Angeles, California 90025 and direct telephone calls to Aloysius T.C. AuYeung (Name of Attorney or Agent), (503) 684-6200.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Title 37, Code of Federal Regulations, Section 1.56
Duty to Disclose Information Material to Patentability

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclosure information exists with respect to each pending claim until the claim is cancelled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is cancelled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclosure all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

(1) Prior art cited in search reports of a foreign patent office in a counterpart application, and

(2) The closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.

(b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made or record in the application, and

(1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim; or

(2) It refutes, or is inconsistent with, a position the applicant takes in:

(i) Opposing an argument of unpatentability relied on by the Office, or

(ii) Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

(c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:

(1) Each inventor named in the application;

(2) Each attorney or agent who prepares or prosecutes the application; and

(3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.

(d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.